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ABSTRACT

Stimulated recall from videotapes of the lessons of six teachers in two elementary schools was used to obtain data on teachers' interactive thoughts and cognitive processes. A content analysis system was developed and used to examine the transcribed recall interviews. The information processing of all six teachers conformed to a broad pattern. Teacher thoughts were principally about lesson tactics to be used next, past lesson events, expectations for students, and predictions about future lesson developments. Teachers had few thoughts about lesson plans, lesson objectives, past teaching behavior, and its impact on students and the lesson. Some cognitive behavior of teachers was similar to that of clinicians. (Authors)

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Thought Processes of Teachers

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Thought Processes of Teachers

At intervals over the last one or two decades, the notion of studying the covert mental behavior of teachers has been advanced (Berliner, 1976; Dunkin & Biddle, 1974; Gage, 1963; Smith & Geoffrey, 1968; and Snow, 1968). Proponents of this idea are optimistic that a study of teachers' cognitive processes, their capacities and limitations for processing information during instruction, and the ways in which they cope with the demands of the task environments, could yield knowledge which would improve conceptualizations of teaching and current prescriptive models of teaching, and which would assist in the development of preservice and inservice programs, record-keeping methodologies, and the installation of curriculum innovations.

Until quite recently, educational researchers have paid little heed to this suggested field of inquiry. As Shulman and Elstein (1975) have observed: "Research typically slights the problem of how teachers think about their pupils and instructional problems; it concentrated instead on how teachers act or perform in the classroom" (p. 3).

The current wave of interest in the mediating process of teacher thought has received impetus from the contemporary interest in information processing theory and from the successful and fruitful application of research methods from this research tradition to the topics of human inquiry and problem solving behavior in several fields such as medicine (Elstein & Shulman, 1971), clinical psychology

(Kleinmuntz, 1968), and chess and symbolic logic (Newell & Simon, 1972).

Some recent research at the University of Alberta (MacKay, 1977) focused on teacher thought processes during instruction. The purpose of the research was to investigate the kinds of information teachers processed during instruction and the ways in which the information was processed. Stimulated recall techniques were used with a group of teachers who were participating in an intensive study of classroom behavior, contextual factors, and pupil-product measures. Only the results of the stimulated recall portion of the study will be reported here.

Stimulated recall has been used, most notably, by Lee Shulman and his colleagues at Michigan State. Their work in medical education (Elstein & Shulman, 1971); Elstein, Kagan, Shulman, Jason & Loupe, 1972) has indicated that the technique is a promising one for those who try to describe human thought processes. The basic assumption is that introspection is a valid method of determining what people think, how they solve problems, how they process information, and so on. From an epistemological standpoint, the technique gets at act meaning (Kaplan, 1961) rather than action meaning. Perhaps because the technique is somewhat in the no man's land between the disputants from two major schools of psychology, it has not received the use or attention it seems, at first glance, to deserve.

Bloom (1954) was one of the first researchers in the recent past to use a type of introspection to uncover the covert thought processes of participants in a group learning experience. The technique was not

applied to questions about human learning in any very serious way until Kagan, Krathwohl, Goldberg and Campbell (1967) and the Shulman group began their work and the literature received its first major infusion of new knowledge with the publication of the Shulman and Elstein paper.

It seems to make good sense to ask a person, such as a teacher, to think aloud while he carries out his job. It would be desirable, as was done in the medical diagnosis studies at Michigan State, to pick up those thoughts while the task is actually being carried out; but such an activity would interfere so much with the task itself that the date would be of interest mainly as a curiosity. However, the recording of classroom behavior on videotape and the use of videotape as a stimulus seemed to us, at Alberta, to have some promise. While the triangulation with different data sources used in the medical education studies and in the study which Elliott (1976-1977) reported would not be fully realizable for us, we did have one other source of data. While the classrooms in which our teachers worked were being videotaped, an observer was picking up low inference data on the dyadic interaction between the teacher and pupils (Brophy & Evertson, 1973). Therefore, in a very real sense, we were able to obtain <u>action meaning</u> to complement the <u>act meaning</u> as recalled by the teacher. In another paper, we intend to examine our stimulated recall and dyadic interaction data together to see what the combined data will tell us. For the moment, our focus is upon the recall data alone.

Procedure

The subjects in the study were six teachers, one from each of the

first, third, and sixth grade levels in two schools in a Canadian urban school district. They had volunteered to participate in the study which was conducted in May and June of 1976. Videotape recordings of two one hour periods were made in each classroom and subsequently shown to each teacher in order to stimulate the recall of their thoughts during the class. The stimulated recall sessions involved the teacher and an interviewer who viewed the videotape together. The sessions were recroded on an audiotape which formed the primary data base for the study.

Before each period of videotaping the teacher was interviewed in order to determine what goals he had in mind at that point and what plans or procedures he intended to use to achieve the goals. This interview was recorded on audiotape. The videotaping of classroom interaction took place shortly after the interview. Then, at the end of the same school day, the interviewer and teacher conducted the stimulated recall session. Between the actual lesson and the recall session, the interviewer had previewed the videotapes to identify segments which appeared most significant for investigating interactive thought processes. The total length of all segments used in any one interview ranged from 20 to approximately 30 minutes. The interviewer and teacher were seated at a table positioned such that they could look at a TV monitor and, yet, be able to hear each other fairly easily. The teacher had, prior to the session, been advised of the goals of the research and invited to provide a detailed account about: (a) thoughts, feelings, and moment to moment reactions, and (b) conscious

choices, alternatives considered before making a choice, and the reasons for making a choice.

The teacher was encouraged to become familiar with the operation of the VTR and given some time to view his own tape before the session began. When the interviewer was satisfied that the teacher was prepared, the audiotape recording and VTR unit were switched on and the interview began.

The interviewer's role during the session was to assist the teacher in recalling covert thoughts and feelings. The teacher decided when to stop the tape and to reflect on his thought processes although the interviewer was instructed to focus on segments which were fairly rich with interactive data if the teacher failed to step the tape at such points.

No evaluative feedback of any kind was provided by the interviewer, who, in many senses, behaved as an open, accepting, counselor would have behaved. The interview proceeded until the teacher decided that he had said all he felt inclined to say about his thoughts during the segments of the lesson.

The audiotapes were later transcribed into typed form and in that form the data were analyzed.

Analysis

A central problem of research employing introspective techniques is analysis of the masses of verbal report data which result. The treatment of such data, usually involving a content analysis system, remains as much an art as a science (NIE, 1975). Since no existing instrument for the analysis of teachers' interactive[1] thought data

could be located, a content analysis system, System for the Analysis of Teachers' Interactive Thought (SATIT), was developed. The use of this system requires, as a first step, the application of rules to distinguish between interactive thoughts and all other thoughts (non-interactive) reported in the interviews. The interactive portions of the protocols were then reduced to units (an ideational unit similar to the one employed by Bloom (1954) was used); each unit was then placed into one of eleven system categories. These categories had been developed on a trial-and-error basis during a lengthy period of familiarization and preliminary analysis of the data. The eleven categories of SATIT, briefly described, are:

Perceptions: units in which the teacher reports a sensory experience (e.g. what was seen or heard).

Interpretations: units in which the teacher attaches subjective meaning to his perceptions.

Prospective Tactical Deliberations: units in which the teacher is thinking about what he plans to do at some future point in the lesson.

Retrospective Tactical Deliberations: units in which the teacher is contemplating a course of action which he has already used in the lesson.

Reflections: units in which the teacher is thinking about past aspects of, or events in, the lesson other than what he has done.

Anticipations: speculative thoughts or predictions

made interactively about what could, or is likely to occur in future phases of the lesson.

Information--Pupil: units in which the teacher's thoughts are centered on his prelesson knowledge of students.

Information--Other: units in which the teacher's interactive thoughts are focused on other information which he brings to the lesson such as general knowledge, pre-instructional plans, school policies, and educational theory.

Goal Statements: units in which the teacher's thoughts are about intended pupil outcomes.

Fantasies: units in which the teacher is expressing fanciful, bizarre, or extravagant thoughts.

Feelings: units in which the teacher is reporting emotions experienced during the lesson.

Once the protocols from the 12 interviews had been coded according to this system, the frequencies of thoughts in each category for each lesson were expressed as percentages of the total number of interactive thoughts in each lesson. Intercoder reliability measures of about .70 were achieved with two briefly-trained coders and short term (two month) intracoder reliability of .85 and above was obtained using Scott's formula which, reputedly, yields a conservative estimate of reliability (Ober, 1971).

A secondary and more detailed analysis of the interactive thoughts in each of the six higher frequency SATIT categories was

undertaken, also on a lesson-by-lesson basis, by classifying thoughts in each category in terms of the referents or substantive components of thoughts. For example, reflections were classified according to whether the teacher was thinking about lesson content, materials, time, classroom atmosphere, student behaviors and characteristics, and so on.

In addition to the micro-analysis of the stimulated recall protocols, reported above, the interview data was also examined for the occurrence of the following broader or molar phenomena[2] which had been identified during a preliminary reading and study of the protocols:

decision: a conscious choice; alternatives considered and factors governing choice of alternative were also recorded;

deliberate act: an instance where a teacher reported planning the next tactic to be used in a lesson without considering an alternative;

proactive teaching: an instance of proactive teaching was recorded when the teacher reported thoughts indicating that his personal interaction with a student reflected deliberate planning and control;

principal: a maxim, working hypothesis, or fundamental law that a teacher consciously holds and which exercises a directing influence on his classroom behavior.

case history: mental inventory of facts, opinions, beliefs, attitudes, etc. that a teacher holds about a student.

Results

The small number of volunteer teachers (six) and videotaped lessons (two per teacher) used in this study preclude the making of generalizations; however a number of trends emerged which are supportive of findings reported in other information processing studies of teachers and which appear significant for gaining an understanding of teachers' cognitive functioning during instruction.

Interactive Information Processing

Within some fairly generous tolerances, it can be said that the information processing of teachers in the Alberta study followed a clearly marked pattern. All teachers reported thinking most frequently about the instructional tactics they were going to employ next in the lesson (prospective tactical deliberations) and about what had already occurred in the lesson (reflections). These two categories of interactive thoughts comprised close to half of all the interactive thoughts reported in each of the lessons. However teachers gave little thought to what they themselves had done in the lesson or its impact on the class and lesson--retrospective tactical deliberations consistently represented fewer than 3% of all interactive thoughts. Teachers also retrieved from memory information about students and other lesson-relevant matters to about the same extent and used this information (Information--Pupil and Information--Other categories in SATIT) interactively. The tendency towards congruence in information processing among teachers also was revealed in the findings that their interactive thoughts contained about the same proportions of anticipations,

interpretations, and feelings and an extremely low percentage of thoughts about lesson goals during instruction.

Interactive Decision Making

A view of the teacher as a decision maker has been popularized by those who have hypothesized that teachers make hosts of individual decisions during instruction (Farr & Brown, 1971; Gagne, 1976; Shavelson, 1976; Whitfield, 1974(a); 1974(b)). To date, this topic has been the subject of only a handful of research studies but, from the Alberta study and others, it appears that decision making during instruction is not as prevalent as expected. Though teachers were asked to report all instances of interactive decision making, and interviewers probed constantly in an attempt to have teachers disclose all the decisions they made, usually fewer than 10 decisions per lesson were reported (range for the six teachers: 3 to 11; mean: 6.8). Further analysis of the interactive decisions of teachers participating in the Alberta study revealed that the number of alternatives considered per decision rarely exceeded two and that, in making their choices of alternatives, teachers considered only two or three factors. These findings are consistent with that reported by Clark and Peterson (1976) who observed that it was relatively rare for the teachers they studied to be thinking about alternative actions or strategies while teaching. It is also consistent with the findings of the Beginning Teacher Evaluation Study (Morine & Vallance, 1975). In the latter study it was reported that Grade II and V teachers averaged from 9.6 to 13.9 decisions per lesson and considered an average of from 2.2 to 3.7 alternatives per

decision.

A phenomenon which occurred with much greater frequency in the protocols of all six teachers was the deliberate act (average number of deliberate acts: 21.5 per lesson). Twenty to thirty times in each lesson, five of the six teachers reported planning a tactic to be used in the lesson but without considering more than one alternative. At these times teachers also reported considering only one or two factors at least.

Taken together, the number of points at which decisions and deliberate acts were planned suggests that there were usually at least 30 or more potential decision points in a lesson. Intriguing questions are: Why, then, was interactive instructional planning of such limited rationality? Can decision making be the basic teaching skill as Shavelson (1973) proposed?

As Jackson (1968) has pointed out, the teacher's task environment may impose severe restrictions on the applicability of a rational model for describing teaching. This is probably so because the pace of classroom life is frequently so rapid that teachers can do little more than react just to keep up. Certainly, the impression gained from analyzing the stimulated recall protocols was that few decisions were made by teachers during periods of intense fast-moving lesson activity.

It is also possible that the number of decisions reported in the protocols was depressed by teachers' lack of familiarity with the use of the decision making metaphor to describe their cognitive behavior during instruction. Teachers may have experienced difficulty in

1. The way teachers generated alternatives was reminiscent of the way that physicians, during simulated medical inquiry interviews, leaped to a small array of provisional hypotheses to account for the medical facts and symptoms of their "patients".

2. The number of competing alternatives considered by the teachers was small, as was the range of competing hypotheses entertained by the physicians.

3. The inattention by some physicians to negative instances parallels the teachers' apparent lack of critical concern about the value of the alternatives from which they were making choices.

It seems reasonable to suggest that the human's limited capacity for rational thought (Goldber, 1968; Radford, 1974), together with constraints imposed by the teacher's task environment, probably more stringent in the case of the teacher than the physician, limit the usefulness of a rational model for describing teaching. At the same time the concept of training teachers to apply a decision making model of teaching appears to merit consideration. Logically, efforts to improve the quality of interactive decision making and thinking by teachers, should result in improved instruction, though the relationship between improving decision making, which might be equated with increased rationality, and instructional processes and outcomes is still open to question.

fitting their interactive thoughts into the decision making paradigm with the result that fewer decisions and decision components were reported than actually occurred. The assumption that teachers' verbal reports are accurate representations of their covert thoughts and thought processes could also be called into question.

Interviewing techniques may also have contributed to the dearth of decisions in the protocols. Opportunities for identification of decisions may have been overlooked by both interviewers and interviewees though this is considered unlikely.

No categorical proof can be given that decision making of the teachers in the sample was, or was not, of limited rationality, but the weight of available evidence is on the side of limited rationality. No evidence could be found, for example, that teachers ever considered the propriety of the alternatives they generated. Alternatives seemed to 'pop up' spontaneously, as if ready made. Teachers then gave reasons for choosing one or the other, but did not think about the desirability of the proposed alternatives vis-a-vis other alternatives.

There are at least three interesting parallels between the interactive decision making of teachers in the Alberta study and the medical reasoning of physicians as reported by Elstein et al (1972).

Interpretations

Interpretation was the term given to the inferences that teachers made about the cognitive and affective conditions of learners during instruction and reported in stimulated recall interviews. By definition, interpretations are based on the teacher's prior perceptions of students. In all six teachers interpretations usually made up about 10% of their reported interactive thoughts and were substantially represented in the factors considered by teachers in decision making and in planning deliberate acts.

Teachers made inferences about the emotions that students were experiencing, whether or not students were feeling motivated to work, and what and how they were thinking, and they attributed to students certain motives for behaving and responding as they did and, also, certain needs and desires. Something is known about the bases of theses interpretations but in this study nothing is known about their accuracy. From what teachers disclosed during stimulated recall interviews, it would appear that teachers were making these inferences about students on the basis of gross and clearly observable student behavior, but without attending much to the subtle less overt cues which students presumably provide such as facial expressions, gestures, and verbal emphases. Such cues would seem to be important indicants of students' inner states. It is also possible, of course, that interpretations were based on information undisclosed in the

interviews. Two questions appear to be of critical importance: Do teachers make accurate interpretations? If so, what evidence do they use? These questions, to which there are currently no answers, appear to warrant further consideration because teachers use interpretations in decision making and planning deliberate acts. Many of the situations in which interpretations were used had to do with customized teacher behaviors, that is, ways of reacting to students which teachers had tailored to suit the specific needs, interests, conditions, etc.--as teachers perceived them--of students. Evidence of customized teaching behavior abounds in the protocols of all six teachers. If interpretations are to serve well the purposes for which teachers were using them, namely, as determinants of decisions, deliberate acts, and customized teaching, then it would seem that, as a basic requisite, the interpretations be accurate. Nowhere in the stimulated recall protocols could evidence be found of teachers questioning the accuracy of their interpretations. Analysis of the videotapes of the 12 lessons used for stimulated recall purposes also revealed that teachers did not seek confirmation from learners about the accuracy of teachers' hunches about the learners' emotional and intellectual states.

Self-monitoring by Teachers

The absence of critical appraisal by the teachers of their own interpretations, discussed in the previous section, appears to be

symptomatic of a general lack of a reflective stance towards their own teaching. None of the six teachers in the Alberta study appeared to be self-monitoring to any significant extent. The index of self-monitoring activity used in making this assessment was the percentage of retrospective tactical deliberations in the interactive thoughts of teachers--usually less than 3%. The concept of the self-monitoring teacher has been endorsed by those who see the teacher as the essential agent in his own professional development. A self-monitoring teacher is one who, in the spirit of self-inquiry and professional development, adopts an objective stance towards his own classroom practice and seeks feedback about his impact on students.

The reasons usually advanced for this lack of self-monitoring activity by teachers during instruction are insufficient time, ego defensiveness, and cognitive overload (Brophy & Good, 1974), and these probably have some legitimacy. The stimulated recall protocols also suggested another potential obstacle to a teacher anxious to be self-monitoring. The teachers occasionally reacted in ways which suggested that the videotaped lessons enables them to see aspects of their teaching behavior which they had not been aware of previously. It was as if self confrontation on videotape suddenly revealed to the teachers new aspects of their teaching which had been obscured before. Even though the point had been stressed that the teacher's interview role did not involve post-lesson self-evaluation, teachers sometimes made

comments which indicated that they had gained new insights about teaching. Here is a typical example:

> T: ...But I see now, it's kind of shocking, my different attitude towards child X who's really the same kind of boy who gets into the same sort of trouble, and child Y...So, I'd better change here.

The clear impression created by these comments is that, to these teachers, classrooms and classroom activities did not provide reflecting surfaces which enabled teachers to "see themselves" at work. The evidence in this study seems to support the notion that the classroom scene, which present to the teacher's senses, such a rapidly changing kaleidoscope of events, prevents the teacher from seeing a clear and stable image of himself. Earlier, Taylor (1968) had concluded that visual cues from students which could be used to provide feedback to the teacher were misleading. Elliott's (1977) triangulation method for improving the capacity of teachers to be self-monitoring, which he claimed met with a measure of success, relied largely on objective feedback from sources external to the teacher.

If, as seems likely, there are numerous impediments to self-monitoring by teachers during instruction, and if it is difficult to suppress interference with self-monitoring to an acceptable level, then adoption of techniques for obtaining feedback from perspectives,

other than the teacher's, for use in post-lesson self-evaluation of teaching behavior appear warranted.

Case Histories

During the interviews, interactive thoughts about pupils were reported, based on information which the teachers had retrieved from memory. Often the two or three interactive thoughts about pupils were enlarged into extensive case histories. This was one of the unexpected features of the stimulated recall interviews and, though it provided a lot of non-interactive data, it was not discouraged; all teachers engaged in this to a greater or lesser extent. Three points are worthy of comment.

Firstly, it showed that teachers do carry round in their heads quite extensive inventories of information about some students at least. The information in these inventories rarely involved terms from the formal vocabulary of the science of human measurement. Instead, student descriptions tended to be common terms from everyday conversation; as well, they were personalized and characterized by considerable diversity. The extent and richness of these case histories suggest that a careful analysis of these mental inventories about pupils could be rewarding. Improved record keeping methodologies for classroom use is one likely benefit.

Secondly, the sets of opinions, facts, attitudes, etc. which comprised the inventories could well be the fertile bases from which

teachers fashioned the customized treatment patterns they used on students. Teachers identified students they did not praise too much because the students did not like it, students whose offers of verbal participation were never turned down because they were considered by the teachers to be shy, introverted, or lacking familiar opportunities for expressing ideas, students who needed all the help and encouragement they could get because of alleged cultural disadvantagement, students volunteering to answer questions whose offers were rarely accepted because teachers attributed to them undesirable motives, and so on.

Thirdly, teachers were often repetitive. They tended to discuss the same group of pupils in both interviews, indicating that some students might have been more prominent in teachers' thoughts than other students. Such a finding was reported in Brophy and Good (1974).

Principles of Teaching

Numerous teaching principles were cited by teachers in the stimulated recall protocols (mean per interview: 9.1). As they did when discussing their mental inventories of students, teachers went far beyond disclosures of just interacting thoughts. The principles discussed in this report thus resided in the interactive as well as the non-interactive portions of the protocols.

Some of the principles appeared to exert a more pervasive influence on teachers' behaviors in the lessons than others and were

common to two or more teachers. Only these principles will be discussed here.

The principle of compensation. Observance of this principle by four teachers necessitated an attempt on their part to compensate the alleged have-nots in their classes for their disadvantagement. They did so by discriminating in favour of the shy, the introverted, the low ability group, and the culturally impoverished, for example, during assignment of classroom duties, selection of respondents to questions, and when attending to pupils offering to participate. Two of the teachers who applied this principle most frequently were Grade One teachers. As the grade level rose the principle appeared to figure less prominently in teaching behavior.

The principle of strategic leniency. This principle is virtually another version of the principle of compensation. One of the four teachers who used the compensation principle indicated that she applied certain classroom rules, formal and informal, with varying degrees of rigor where it appeared advisable to do so. In the application of rules to children the teacher regarded as needing special attention, she was consciously lenient. For example, she disregarded restrictions she had placed on the number of children who could speak at Show and Tell time if one of the have-nots indicated a desire to speak.

The principle of power sharing. One teacher was committed to avoiding the use of negative reinforcement. In the interviews she claimed that she resorted to the use of rewards and punishments only when she became desperate. The commitment of this teacher to

avoidance of negative reinforcement was made apparent to the observer at times when the class was inattentive or noisy and not working productively. Her frequent response was: "I like the way Child A is working/listening/sitting up/behaving." When this strategy was not effective, a sense of powerlessness in the teacher could be inferred from her part of the dialogue in the stimulated recall interview.

What would not be apparent to an observer was that the children she chose to commend were ones whom she perceived to be class leaders, ones whom she assumed exerted some influence over peers by virtue of their having that leadership position. Her theory was that she could use the informal structure of peer influence as an instrument for dispensing her own influence in the class. In this sense then she was sharing power to influence with the informal power structure of peer influence.

The principle of progressive checking. The principle of progressive checking was consciously employed by one teacher during instruction to the lower ability group. Application of the principle entailed making intermittent interruptions during seat work by the low ability group to allow for periodic checking of progress, identification of work problems being encountered, and for giving encouragement. By doing this the teacher also reasoned that she was providing stimulus variation for a group of children with low attention span for whom she considered variability necessary for enhancing learning.

The principle of suppressing emotions. Classrooms have been described as affective deserts and as places in which the serious and often joyless business of learning and teaching in transacted. While these descriptions are probably over-statements of the affective climate in most school learning contexts, classrooms do tend to be places where emotional restraint is encouraged and where expression of feelings is subdued. There is evidence from several sources that the six classrooms in the Alberta study also warrant this conventional description. For example, low inference and high inference data from about 40 hours of observation in the six classrooms show very few instances of praise or criticisms which is other than mild. Additional support for the above assertion appears in the stimulated recall protocols. In the first place, the stimulated recall interviews contained only one instance of a teacher attempting to inject humour into the teaching situation. Secondly, the percentages of interactive thoughts in which teachers expressed feelings are generally low. Taken at face value, these percentages could be taken to mean that teachers experience few emotions during instruction. However, percentages based on the frequencies with which feelings were reported could be misleading because emotional states are usually not ephemeral or fleeting. They tend to endure so one reference to a feeling might represent an affective condition which persists for some time.

It seems likely, therefore, that the outward appearance of

tranquility and nonemotionality in teachers belies their inner affective states. There is support for this position in the principles cited by teachers. Teachers reported that they strove to suppress the feelings they were experiencing. All teachers invoked this principle, some more than others, though this may have been related to circumstances in lessons.

Adoption of this principle was based on a view of themselves as emotional catalysts. If they, the teachers, were noisy and excited, the class would become noisy and excited; if the teacher wanted to induce a state of calm and quiet in the class, then they had to project this in their own behaviors.

This principle was frequently used as a classroom management strategy; its use was manifested in several ways, principally the following:

1. Maintaining silence for a lengthy period.

2. Using nonverbal means of communications. Teachers consciously used gestures, glances, pauses, and stares to suppress unbridled enthusiasm or undesirable behavior by students.

This practice of suppressing emotions was also sometimes coupled with another maxim--protecting students' self-concepts. Efforts to protect students' self-concepts occurred most often during public teacher-student discussion. These teachers indicated a reluctance to tell a student that his answer was incorrect or unsatisfactory,

especially if he was enthusiastic or appeared to be trying as the following quotations indicate.

First teacher: I really try not to say no . . . if I can avoid it. Sometimes it's unavoidable. Sometimes if it's very silly, I'll say no if they're trying and they're just making mistakes, then I try not to say no.

Second teacher: I try a lot of times not to say yes and no or right and wrong. I'm very conscious of that all the time. I think you have to use the word, in an academic sense, very carefully. Especially with the particular children I have . . . some of the children I have.

Third teacher: _____'s sentence wasn't that good. I never quite know whether he . . . I can't say, _____ that's not very good, because the other kids would notice it right away. I often wonder how far you go. You can't discourage them and yet there's a point that you've got to come to and say, 'Well, maybe if could have been a little bit better, _____, if you'd just added such and such.' I remember thinking that at the time, and thinking, 'No, this is not the time to do it.' It

> was the wrong time to do it. It was the wrong time because they were so enthusiastic about their sentences.

Teachers tried to veil their unfavourable judgments of students' answers by resorting to the use of innuendo, and rejected providing direct feedback even at the expense of compromising their academic standards.

Teachers were not always so concerned about being so protective. They were less particular about this maxim if the incorrect answer came from a student who was bothersome or inattentive.

Another motive for teachers applying this principle appeared to be their desire to nurture student participation and interest which were, for them, important ingredients in a successful lesson.

Their dual goals of preserving students' wholesome self-image and retaining lesson momentum which appeared to motivate these teachers add some weight to Kounin's (1970) claim that the social dimension of classroom life is one of the prime concerns of teachers. Further evidence in support of this comes from the expressed desires of teachers to appear just.

Lesson Plans as Topological Workspaces

One of the most unexpected and perplexing features of the interview data was the almost total lack of reference to lesson plans. In all but one interview there was never more than two or three interactive

thought units dealing with lesson plans. That one interview contained seven references to lesson plans. Before an explanation is offered several other points should be noted.

1. Interactive decisions were made about essentially unpredictable specific issues such as choice of respondent, how to desist student noise, and how to respond to child initiated questions and comments. Decisions about broad aspects of lesson design were not taken interactively.

2. The general structure of lessons was outlined in lesson plans but little attention was given to specific matters such as teacher-student interaction.

3. Lesson plans were implemented without any major changes being made. Teachers showed great reluctance to make changes or to abandon lesson plans.

4. Teachers sensed when lessons began to deviate seriously from plans or when plans went awry. At these times the two teachers concerned disclosed in the interviews that they became tense and anxious and sought measures to ensure that the lessons got back on course.

One of the research questions to which an answer was being sought was whether preactive plans impinge on the interactive information processing of teachers. The answer to that question in respect of the teachers in the Alberta study appears to be that plans

did not impinge on their interactive thoughts until disruptions occurred which jeopardized the successful implementation of the plan. Teachers did not report in the interactive data comtemplating what part of the lesson plan came next. However, the appearance of a sub-category of reflections dealing with lesson content and characteristics suggests that these teachers were monitoring developments in their lessons and were checking that they were proceeding according to plan. It would appear that the act of planning a lesson serves to program the teacher to act in a predetermined way. The teacher programs himself to operationalize a plan and then makes periodic checks to ensure that the lesson is "on course".

The notion of a lesson as a topological work space emerged as a useful way to describe what the authors perceived lesson plans to mean to the teachers in the project. In the first place, a lesson plan served a useful function because it defined for them an area of content, resources, and techniques with which they and the students would be working. This was the broad framework or work space. They also recognized, that they were planning for an event which was associated in their minds with a certain degree of uncertainty. Plans, therefore, teachers realized, had to allow for this uncertainty by possessing a looseness of structure and flexibility. The work space therefore had to allow for some give-and-take and for some adjustments and displacements of parts. What teachers did with plans to cause

them to fit the circumstances in lessons, some of which are unknowable beforehand, is analagous to what happens to surfaces in the study of topology, often referred to as rubber-sheet geometry. Where lessons went awry teachers were able to stretch plans to fit new circumstances, to cope with new considerations. Within this topological workspace then the teacher works with his class.

It has already been noted, in reference to interactive decisions, that a very small number of interactive decisions reported by teachers in this study represent modifications to the plans, and virtually none of the decisions represent extensions to preactive plans. Morine and Vallance (1975) reported the same result, noting that unplanned decisions, decisions to include an activity that was not originally part of the lesson plan, comprised only about 3% of all interactive decisions.

The pattern is consistent and clear--preactive decisions or, more correctly, preactive plans and interactive decisions made by the teachers in this study were about two different sets of topics, one general, the other, in the case of interactive decisions, specific and unpredictable.

Conclusion

The findings reported here lead to several suggestions about further research and development activities.

First, the stimulated recall technique should be refined for use

in both naturalistic and laboratory settings. Use in laboratory settings would enable researchers to control the effects of extraneous variables and could lead to a closer replication of the Michigan State studies in medical decision-making.

Second, the data from stimulated recall needs to be cross-validated by comparison with a criterion-based observation system. Such a criterion-based system would provide data clearly related to the substantive areas (e.g. decision-making) to be examined in the recall interviews.

Third, if this line of enquiry is to have impact on teacher education programs, something analagous to the preceptor model for training clinicians (Vinsonhaler, Wagner & Elstein, 1977) needs to be considered. Knowing how teachers currently process information in a naturalistic setting is one thing; but to improve decision-making, some models of effective decision-making should be available in training programs. A simple rational model is likely to be so much out of tune with reality that modelling it would be ineffective. Instead, the processes used by effective teachers should form the basis for modelling.

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Footnotes

[1]Interactive is the term used to denote the phase of teaching when the teacher is involved in instructional activity. Interactive thoughts are those the teacher had during instruction.

[2]Only the most frequently occurring phenomena have been discussed in this article and have been listed here. The protocols were analyzed for the existence of 13 phenomena in all. These phenomena were identified in the non-interactive as well as the interactive sections of the protocols.